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Growth Response of Several Vegetation Species to Herbicides and Manual Cutting Treatments in the Vancouver Forest Region

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SUMMARY

Non-crop vegetation can compete with young conifers, potentially reducing conifer survival and growth rates. Since 1985, FRDA has funded the establishment of several research trials designed to document the effect of herbicides (both registered and unregistered) and manual cutting on vegetation growth. This interim report summarizes the growth response of several vegetation species from one to five growing seasons after these treatments. Herbicides tested included glyphosate, hexazinone, triclopyr ester, sulfometuron methyl, and metsulfuron methyl. Manual cutting treatments were done throughout the growing season. A broad range of vegetation species were well controlled following application of glyphosate (1.8 kg a.i./ha). However *Vaccinium* spp., salal, red-osier dogwood, and hazelnut showed some tolerance. Glyphosate was generally most effective when applied later rather than earlier in the growing season. Hexazinone (4.0 kg a.i./ha) did not give effective control of vegetation species of concern in these coastal ecosystems. As a late-summer foliar treatment, triclopyr ester (2.9 kg a.e./ha) was less effective than glyphosate in controlling the non-crop species examined in these trials. Both thimbleberry and salmonberry showed a moderate degree of resistance. A wide range of vegetation species responses were displayed following application of sulfometuron methyl (0.60 kg a.i./ha) and metsulfuron methyl (0.12 kg a.i./ha). Conifers showed some intolerance to both chemicals. Since many prominent vegetation species in coastal forests resprouted vigorously following cutting of the above-ground portions of the plant, manual cutting provided only short-term control of competing vegetation.

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TABLE OF CONTENTS

SUMMARY iii

ACKNOWLEDGEMENTS iv

1 INTRODUCTION 1

2 METHODOLOGY 1

3 RESULTS 1

3.1 Herbicide Treatments 1
3.1.1 Registered herbicides 1
Glyphosate 1
Hexazinone 4
3.1.2 Unregistered herbicides 4
Triclopyr ester 4
Sulfometuron methyl 5
Metsulfuron methyl 5

3.2 Manual Cutting Treatments 6

4 REFERENCES 6

APPENDICES

1 List of Vegetation Management Research Projects 7

2 Definition of Injury Classes 8

TABLES

1 Summary of herbicides tested, including registration status, mode of plant uptake, rates tested, and number of trials 3

2 First-year growth response of vegetation to manual cutting, by species 3

FIGURES

1 Location of test sites 2

2 Effects of herbicide treatments on trees and shrubs found in coastal and interior ecosystems 4

1 INTRODUCTION

Non-crop vegetation can compete with young conifers, potentially reducing conifer survival and growth rates. Until recently, there were few trials in the Vancouver Forest Region that quantified the efficacy of various vegetation management techniques for controlling those species considered detrimental to conifer development. Since 1985, FRDA has funded the establishment of several research trials designed to document the effect of herbicides (both registered and unregistered) and manual cutting on vegetation growth.

This interim report summarizes the growth response of various vegetation species one to five growing seasons after treatment. Background information on each herbicide is also presented, including registration status, trade name, manufacturer, formulation tested, and route of plant uptake. Some of this information was obtained from the Canadian Pulp and Paper Association (1986). Background information on sulfometuron methyl and metsulfuron methyl came from Du Pont Technical Data Sheets (Du Pont 1983, 1984). The potential importance of each herbicide in a vegetation management program in the Vancouver Forest Region is briefly discussed, focusing on its effectiveness in controlling the growth of those species sampled in these trials.

2 METHODOLOGY

Appendix 1 lists the trials from which data on vegetation response to various treatments were derived. Methodology for these trials generally followed the protocol described in Pollack and Herring (1985). Trial sites were located throughout the region (Figure 1), with the majority located in the Chilliwack Valley. All sites were clearcut between 1 and 3 years before trial establishment.

Table 1 summarizes the herbicides tested and includes information on application rates and timing, manufacturer, trade name, route of plant uptake, and registration status. All herbicide applications, except one, used ground-based application equipment such as a CP-3 backpack sprayer or CO_2-powered backpack sprayer for those herbicides with a water carrier. A hand-crank fertilizer spreader was used to apply the granular hexazinone. A single aerial application of triclopyr ester was completed using a helicopter.

3 RESULTS

Vegetation responses to herbicides and manual cutting treatments are presented separately in Figure 2 and Table 2 respectively. Definition of injury classes used to describe herbicide efficacy are summarized in Appendix 2.

3.1 Herbicide Treatments

3.1.1 Registered herbicides

Glyphosate

Results from the trials examined in this report show that a broad range of vegetation species were well controlled following the late-summer application of glyphosate (Figure 2). Species showing tolerance to glyphosate include *Vaccinium* spp., salal (*Gaultheria shallon*), red-osier dogwood (*Cornus sericea*), and hazelnut (*Corylus cornuta*). Glyphosate was generally most effective when applied later rather than earlier in the growing season.

None of the other herbicides, either registered or unregistered, controlled as broad a range of vegetation species common to coastal ecosystems as did glyphosate. Glyphosate is likely to remain the herbicide of choice for most vegetation management problems in the Vancouver Forest Region in the future.

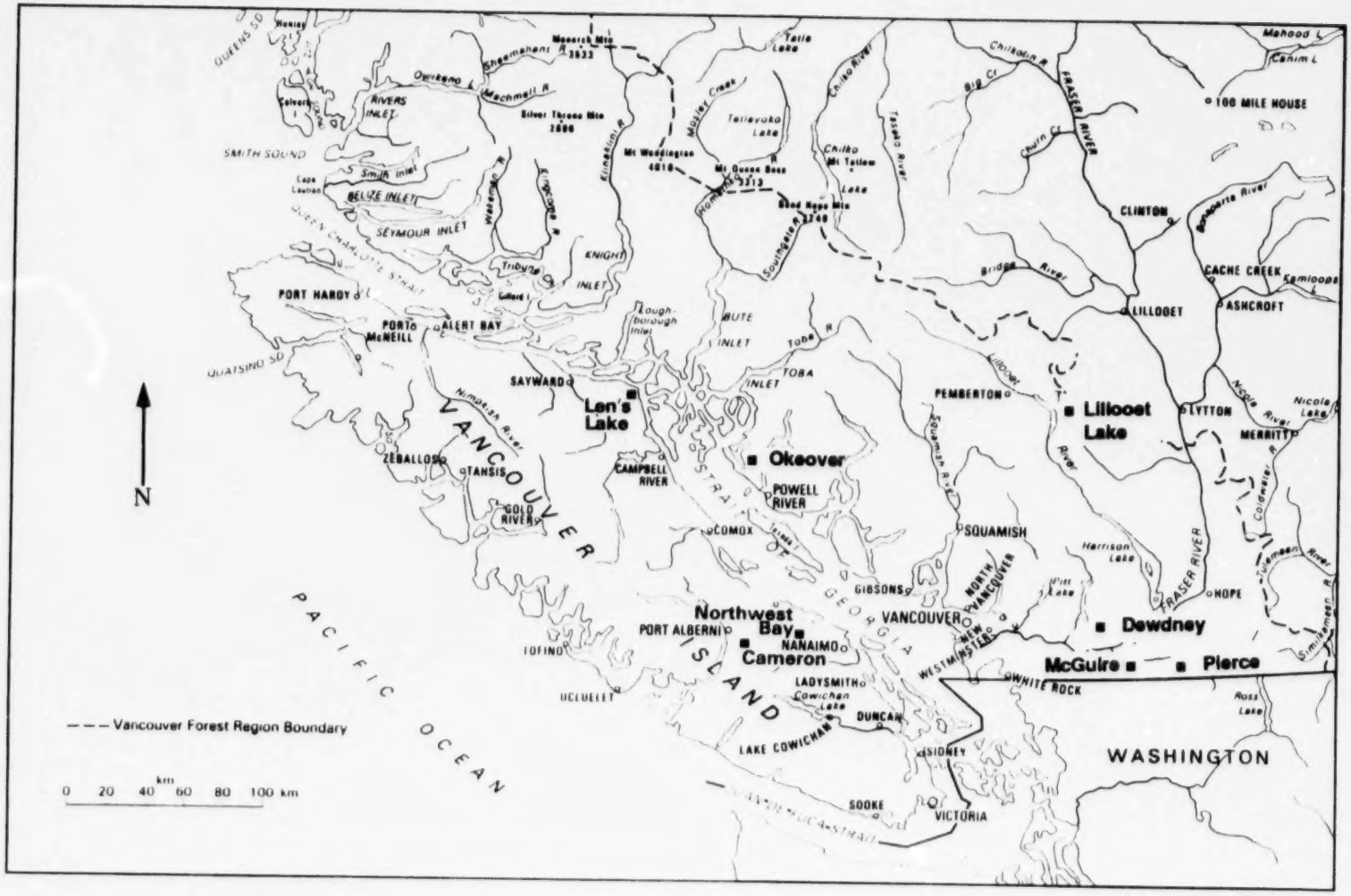

FIGURE 1. Location of test sites.

TABLE 1. Summary of herbicides tested, including registration status, mode of plant uptake, rates tested, and number of trials

Chemical name	Trade name	Formulation	Manufacturer	Registration status	Route of plant uptake	Rates tested (kg a.i./ha)	Seasons of application[a]	Number of trials
Glyphosate	Vision®	Liquid	Monsanto	Forestry	Foliage	1.8	ES, MS, LS	3
Triclopyr ester	Release®	Liquid	Dow Elanco	Research	Foliage, roots	1.5 - 2.9[b]	ES, LS	2
Hexazinone	Velpar L®	Liquid	Du Pont	Forestry	Roots, foliage	4.0	SP	2
Hexazinone	Pronone®	Granular	United Agri Products	Research	Roots	4.0	SP	2
Sulfometuron methyl	Oust®	Granular	Du Pont	Research	Foliage, roots	0.6	SP	2
Metsulfuron methyl	Ally®	Granular	Du Pont	Research	Foliage, roots	0.12	LS	1

[a] Season of application
SP = Spring with vegetation appearing dormant (March-April)
ES = Early summer (June)
MS = Mid-summer after conifer bud set (August)
LS = Late summer (September)
[b] Triclopyr application rates in kg a.e./ha

TABLE 2. First-year growth response of vegetation to manual cutting, by species. Plants were approximately 2 years old when cut.

Vegetation Species	Mortality (%)	1st Year height growth		No. of stems compared to pretreatment	% of pretreat. cover	Effect of timing of cut
		cm	% of pretreat. height			
Thimbleberry	0	60 - 100	90%	.6 - 1.0 X	50 - 80%	No practical differences during the growing season
Hazelnut	0	100 - 120	65%	1.5 - 2.1 X	55 - 100%	No practical differences during the growing season
Ocean spray	0	75	50%	1.7 X	190%	?
Salmonberry	0	60 - 100	90%	1.0 - 1.1 X	60 - 90%	No practical differences during the growing season
Elderberry	0	85 - 125	65%	1.0 - 2.0 X	30 - 70%	No practical differences during the growing season
Sword fern	0	60 - 75	75%	0.3 - 0.8 X	60 - 120%	?
Red-osier dogwood	*	100	*	*	130%	?
Black twinberry	*	150	*	*	130%	?
Bigleaf maple	0	130 - 170	50 - 65%	1.6 - 2.0 X	50 - 80%	No practical differences during the growing season
Birch	0	100 - 200	40 - 70%	2.0 X	65 - 95%	No practical differences during the growing season
Red alder	20 - 95	100 - 200	25 - 50%	5.0 - 10.0 X	—	Resprouting vigour decreases with cut later in the growing season
Black cottonwood	0	150 - 170	60 - 70%	5.0 - 10.0 X	70 - 80%	No practical differences during the growing season

* = not measured
? = sample size does not allow firm conclusions

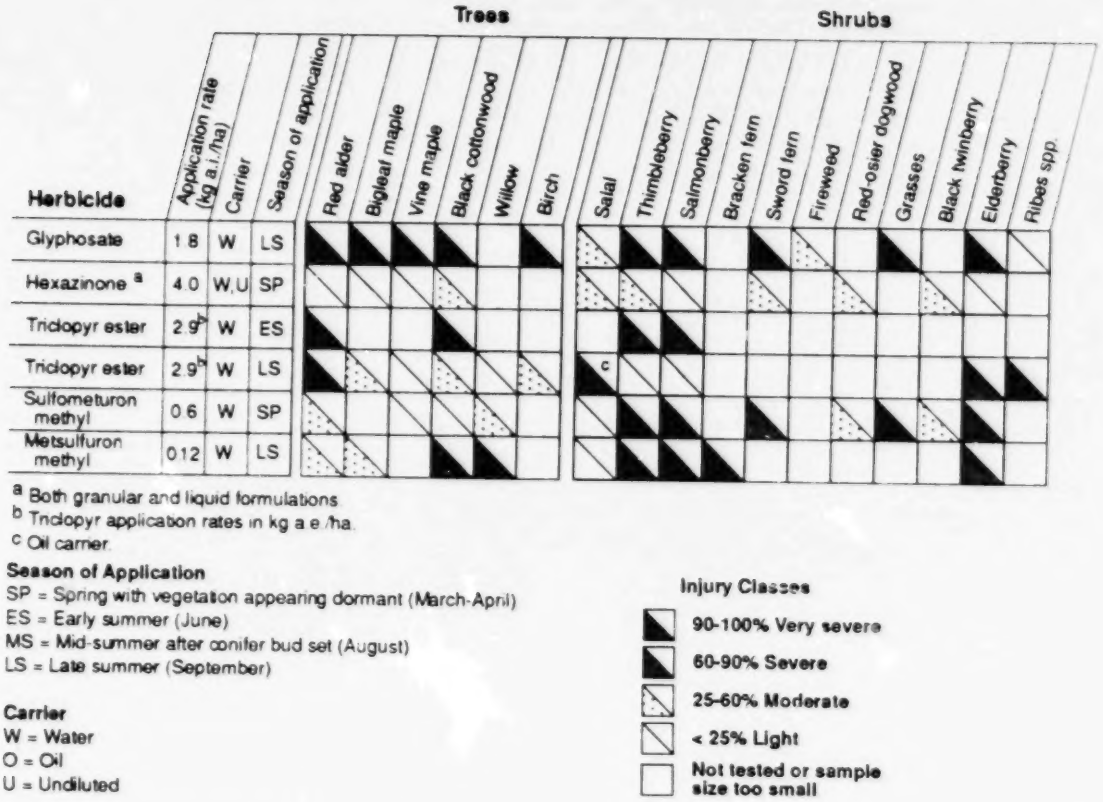

FIGURE 2. Effects of herbicide treatments on trees and shrubs found in coastal and interior ecosystems. Vegetation generally under 4 years old when treated. All treatments broadcast applied.

Hexazinone

The response of the various vegetation species to applications of the granular and liquid formulations of hexazinone were so similar that the results were combined into one entry in Figure 2. Overall, the hexazinone treatments tested did not give effective control of vegetation species at the application rates tested (4.0 kg a.i./ha). Most species recovered, and reached or exceeded pretreatment cover and height by the second growing season following hexazinone application. The spot application of liquid hexazinone occasionally killed a smaller target tree outright (e.g. red alder (*Alnus rubra*) and black cottonwood (*Populus balsamifera* spp. *trichocarpa*)), but only if the spot was directed close to the stem.

Hexazinone was not effective for controlling any of the major vegetation species in these trials and therefore does not appear to be an appropriate treatment for vegetation management problems in the Vancouver Forest Region.

3.1.2 Unregistered herbicides

Triclopyr ester

As a late-summer foliar treatment, triclopyr ester was less effective than glyphosate in controlling the non-crop species examined in these trials. Thimbleberry (*Rubus parviflorus*) and salmonberry (*Rubus spectabilis*), for example, both show a moderate degree of resistance to the herbicide. Red

alder, however, was effectively controlled even at the lower application rate tested (1.4 kg a.e./ha). Conifer tolerance to triclopyr ester was generally high. Triclopyr ester, when applied in diesel oil carrier, is one of the few herbicides which significantly damages salal. Unlike glyphosate, triclopyr was more effective on some species when applied in the early summer (June) period than later in the growing season (September). Thimbleberry, salmonberry and black cottonwood all showed greater susceptibility to triclopyr in early foliar application periods.

Triclopyr ester can also be used as a basal treatment, either diluted with diesel oil or used undiluted. Recent trials on 2-year-old sprout clumps of bigleaf maple (*Acer macrophyllum*) indicate excellent control using the triclopyr ester undiluted in thin complete rings around all stems ("thinline method"). Triclopyr ester applied at 3% concentration in diesel oil was much less successful on the maple.

Following recent registration for industrial and right-of-way use in Canada, registration of triclopyr ester for forest use is expected early in the 1990's. Triclopyr ester has the potential to be an effective treatment where red alder is the primary vegetation management concern. It may also prove to be a useful tool for controlling bigleaf maple and salal. The effectiveness of early foliar treatments with triclopyr will also provide a longer window for the use of herbicides in releasing conifer seedlings.

Sulfometuron methyl

A wide range of species responses was displayed following the dormant application of sulfometuron methyl at a relatively high application rate (0.6 kg a.i./ha), compared to rates tested by Newton and Cole (1989) and suggested for use in Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) plantations (0.2 kg a.i./ha). Herbs, grasses and *Rubus* species were effectively controlled, but vine maple (*Acer circinatum*), black cottonwood and salal showed high tolerance. Red alder displayed moderate levels of damage in the year following herbicide application, but recovered in subsequent growing seasons. Both grand fir and Douglas-fir displayed reduced height growth and chlorotic, deformed foliage during the growing season following this high application rate. During the following growing season, both species recovered.

Although this product effectively controlled several species, future registration of sulfometuron methyl for forest use is not currently being pursued by the manufacturer. If registration of sulfometuron methyl is reconsidered in the future, field testing should test lower application rates (< 0.25 kg a.i./ha) and application dates throughout the growing season. Future research direction should also consider the sulfometuron methyl research already completed in the Pacific Northwest and summarized by Newton and Cole (1989), including the possibility of mixing the chemical with other herbicides (eg 2,4-D) to broaden the spectrum of herbicide effectiveness. Since sulfometuron methyl seems to be ineffective in controlling most woody species other than *Rubus* spp., it will probably not become a major tool (on its own) for vegetation management in coastal ecosystems.

Metsulfuron methyl

Rubus species, black cottonwood, willow (*Salix* spp.) and bracken fern (*Pteridium aquilinum*) were effectively controlled by a late-summer (September) application of metsulfuron methyl (0.12 kg a.i./ha). Red alder proved highly tolerant to this chemical. Grand fir tolerance was low at this application rate. Newton *et al.* (1985) showed salmonberry has been controlled at rates as low as (0.06 kg a.i./ha), reflecting the highly active nature of the chemical.

Potential for future registration of metsulfuron methyl for forestry use is currently unknown. Additional research with this chemical, if considered a priority, should test lower application rates than applied in these trials. Research on the use of this chemical for controlling herbaceous and woody plant growth is under way in the Pacific Northwest (Newton *et al.* 1985; Wagner 1987). Results from those trials show metsulfuron methyl gave effective control of salmonberry and blackberry (*Rubus* spp.), but poor control of red alder.

3.2 Manual Cutting Treatments

Information summarizing the 1st-year growth response of various vegetation species to manual cutting (Table 2) was obtained principally from FRDA experiment 2.35. The trial investigated the response of vegetation, by species, to manual cutting during different periods in the growing season. Additional information was obtained from single manual treatments carried out in association with other trials. In total, manual treatments were completed at six different sites using both circular saws and chainsaws, cutting stems as low to the ground as possible. Cut materials were left in place.

Most species sampled resprouted vigorously following cutting, measuring greater than 50% of pretreatment height and canopy cover by the following growing season. Plant mortality was rare. The number of stems usually increased following cutting for the species sampled in this study. Timing of cut during the growing season seems to have little effect on the regrowth of most of the species. Red alder, however, displays much less vigorous resprouting when cut later in the growing season.

In conclusion, since many prominent vegetation species in coastal forests resprout vigorously following cutting of the above-ground portions of the plant, manual cutting provides only short-term control of competing vegetation. Results from these studies indicate that herbicides provide a more reliable and longer-term control of those vegetation species considered important competitors to conifer growth and survival. Glyphosate in particular gave effective control of several species.

4 REFERENCES

Canadian Pulp and Paper Association. 1986. Pesticides: technical references kit. Montreal, Que.

Du Pont. 1983. Technical data sheet for sulfometuron methyl. Du Pont. Inc., Wilmington, Del.

_____. 1984. Technical data sheet for metsulfuron methyl. Du Pont. Inc., Wilmington, Del.

Newton, M. and E.C. Cole. 1989. Where does sulfometuron methyl fit in Pacific Northwest silviculture? CRAFTS, Oreg. State Univ. Corvallis. Oreg.

Newton, M., E. C. Cole, and D. E. White. 1985. First year evaluation of Arsenal® and Escort® herbicides in the Oregon Coast Range. For. Res. Lab. Oreg. State Univ., Corvallis, Oreg.

Pollack J. and L. J. Herring. 1985. Experimental design protocol for forest vegetation management research: Level A trials. 1st approx. B.C. Min. For. Lands. RR 84102-HQ .

Wagner, R.G. 1987. First-year results from treatments to control bigleaf maple sprout clumps. CRAFTS, Oreg. State Univ., Corvallis, Oreg.

APPENDIX 1. List of Vegetation Management Research Projects

1. Effect of manual treatment timing on red alder regrowth and conifer response at Okeover Inlet. 5th-year report. FRDA 2.12
2. Impact of sulfometuron methyl, hexazinone and manual cutting on the growth response of several vegetation species - McGuire Creek. 3rd-year report. FRDA 2.15
3. Effect of application timing on the response of several vegetation species to the application of glyphosate and triclopyr ester and manual cutting. 2nd-year report. FRDA 2.14. EP 985.03.
4. Evaluation of several control methods on bigleaf maple. 1st-year report. EP 985.07
5. Evaluation of manual cutting as a conifer release treatment. FRDA 2.35
6. Evaluation of triclopyr ester as a conifer release treatment. 3rd-year report. FRDA 2.13. EP 985.05.
7. Evaluation of several herbicides for the control of salal.3rd-year report. FRDA 2.17. EP 985.06.
8. Impact of sulfometuron methyl, hexazinone and manual cutting on the growth response of several vegetation species - Pierce Creek. 3rd-year report. FRDA 2.8. EP 985.01.

APPENDIX 2. Definition of Injury Classes

Class	Description
Very severe (90-100%)	Species is completely removed from the majority of plots (≥50%) in which it occurred before treatment; or the species survives the treatment but undergoes significant reduction in cover (>90%).
Severe (60-90%)	Species is completely removed from a minority of plots (<50 %) in which it occurred before treatment. Where the species survives, the treatment cover is reduced by at least 40%.
Moderate (25-60%)	Species rarely removed from the plot by the treatment. However, the plant exhibits easily visible above-ground damage and reduction in cover.
Light (< 25%)	Species very rarely removed from the plot by the treatment. Above-ground portion of the plant shows little or no damage.